AT ENTERPRISES

UDC 666.21:666.921.34

GRINDING HIGH-QUALITY AND ART GLASS WITH DIAMOND GRINDING WHEELS WITH ORGANIC BINDERS

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Translated from *Steklo i Keramika*, No. 5, pp. 33 – 34, May, 2008.

It has been found that using the new organic binder MV1 with grinding powder with grain size 45/38 μm instead of the binder M2-01 with micropowder grain size 30/40 μm increases the productivity of the final diamond grinding of high-quality and art glass by a factor of 2 – 2.5 without any subsequent chemical polishing and decreases the roughness of the worked surface by 20% with 14 – 28% higher specific consumption.

Manufacturers of diamond grinding wheels are faced with the problem of manufacturing enhanced-productivity wheels because the cost of producing articles made of high-quality and art glass is continually increasing in the Russian Federation and Czech Republic. A range of organic binders has been proposed to solve this problem.

The investigations were performed by the GOST 30352–96 procedure on a special bench with a general-purpose sharpening machine tool [1]. The sample is clamped to the grinding wheel by the mass of a counterweight, acting through blocks placed on the bench frame, and monitored with a dynamometer with scale division 1 N. The grinding depth was monitored with a depth gauge with scale division 0.1 mm. Grinding was performed with 1E1 and 1A1 wheels with M2-01 metal binder with HRB hardness 85 – 95 with AS20 diamond powder and with a new organic binder MV1 with HRB hardness at least 105 with AS6 diamond powder. The speed of the wheel was 26 m/sec. Glass bars, containing 24% PbO, with dimensions 150 × 100 × 20 mm were ground. Water was used as the lubricating-cooling liquid. The specific consumption of diamonds was determined by weighing on VLT-1-1 balances, and the roughness of the worked surface was measured with a model 201 profilograph-profilometer manufactured by "Kalibr" Works. Each experiment was repeated at least five times to determine the average value of the specific consumption of diamonds and the cutting power of the wheel.

Measurements of the roughness of the surface worked by wheels with metal and organic binders showed (Fig. 1) that the roughness increases with increasing diamond powder grain size. The roughness of the surface worked with wheels with organic binder is smaller than the roughness obtained with metal binder with the same grain size of the diamond powder. The roughness of the worked surface was 0.65 μm on the average for wheels with M2-01 binder and diamond micropowder grain size 30/40 μm and 1.4 – 1.5 times smaller (to 0.36 μm) for MV1 binder with micropowder with the same grain size. Using a wheel with MV1 binder with

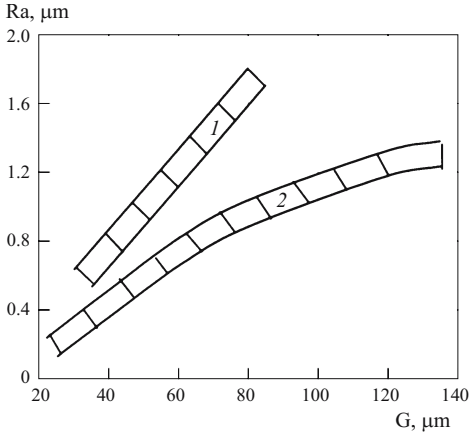

Fig. 1. Roughness Ra of the worked surface versus grain size G after grinding with wheels with M2-01 (*1*) and MV1 (*2*) binders.

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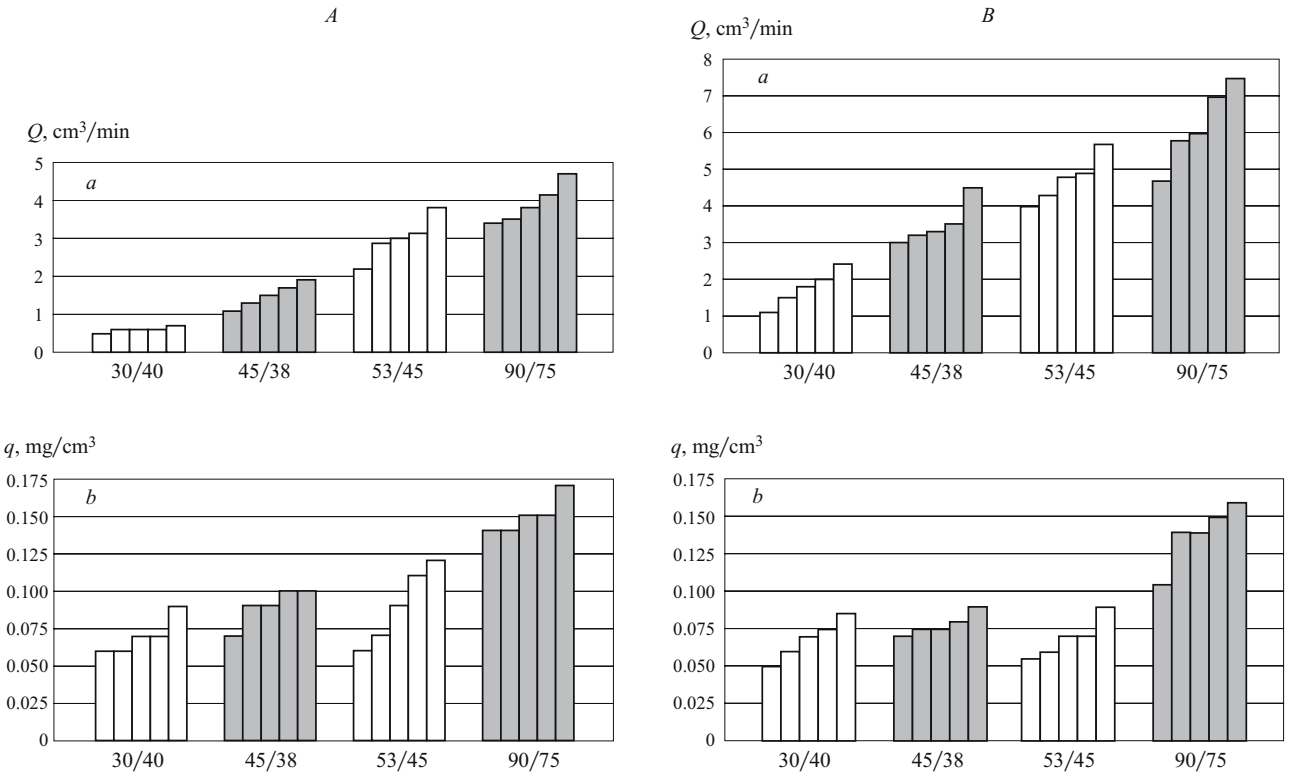

Fig. 2. Cutting power of wheel Q (*a*) and specific diamond consumption q (*b*) of powders with different grain size for 1E1 (*A*) and 1A1 (*B*) wheels.

grinding powder grain size 53/45 μm instead of M2-01 binder with the same powder grain size decreases the roughness of the worked surface by a factor of 1.3 – 1.4.

Thus, the fundamental possibility of obtaining the same roughness of the worked surface using wheels with organic binder with a larger grain size rather than wheels with metal binder and smaller grain size has been established.

Wheels with 30/40 μm diamond micropowder are now mainly used for final grinding of high-quality and art glass without subsequent chemical polishing. Consequently, the possibility of using wheels with MV1 binder with 45/38 μm diamond powder grain size instead of 1E1 and 1A1 grinding wheels with M2-01 binder and 30/40 μm micropowder grain size was investigated.

In the tests of 1E1 wheels (Fig. 2, *A*) with grain size 30/40 and 45/38 μm the clamping force was 15 Pa and the grinding depth was 2 mm. It was determined that using the MV1 power with grain size 45/38 μm instead of M2-01 binder with 30/40 μm micropowder increased the productivity of grinding by a factor of 2.5 and decreased the roughness of the worked surface by 20% with 28% higher specific consumption.

In tests of 1A1 wheels (Fig. 2, *B*) with 30/40 and 45/38 μm grain size the clamping force was 40 Pa and the grinding depth was 1 km. Using MV1 binder with powder grain size 48/38 μm instead of M2-01 binder with micropowder grain size 30/40 μm increased the grinding productivity by factor of 2.1 and decreased the roughness of the worked surface by 20% with 14% higher specific consumption.

Wheels with diamond powder with grain size 53/45 and 63/53 μm are currently mainly used for grinding glass followed by chemical polishing [2]. Consequently, the possibility of using wheels with MV1 binder with AS6 powder with grain size 90/75 μm instead of 1E1 and 1A1 wheels with M2-01 binder with AS20 powder with grain size 53/45 μm was investigated.

In tests of 1E1 wheels with grain size 53/45 and 90/75 μm the clamping force was 40 Pa and the grinding depth was 3 mm. Using MV1 binder with powder grain size 90/75 μm instead of M2-01 binder with powder grain size 53/45 μm increased the grinding productivity by 30 – 40% with the same roughness of the worked surface and with 1.8 – 1.9 times higher specific consumption.

In tests of 1A1 wheels with grain size 53/45 and 90/75 μm the clamping force was 40 Pa and the grinding depth was 2 mm. It was found that as a result of using MV1 binder with powder grain size 90/75 μm instead of M2-01 binder with powder grain size 53/45 μm the grinding productivity increased by 25 – 35% with the same roughness of the worked surface and with 2 times higher specific consumption.

The MV1 binder was recommended for commercial production of wheels to be used for final grinding of high-quality and art glass without subsequent chemical polishing. Wheels with MV1 binder are now being used successfully at 30 enterprises in the Czech Republic.

The present investigations have established that the worked-surface roughness obtained with wheels with organic binder with AS6 diamond powder is 1.3 – 1.5 times smaller than the worked-surface roughness obtained with wheels with metal binder with AS20 diamond powder with the same grain size.

The use of the new organic binder MV1 with grinding powder grain size 45/38 μm instead of M2-01 binder with micropowder grain size 30/40 μm has made it possible to increase the productivity of final diamond grinding of high-quality and art glass without subsequent chemical polishing by a factor 2 – 2.5 and to decrease the roughness of the worked surface by 20% with 14 – 28% higher specific consumption.

REFERENCES

1. M. F. Semko, M. D. Uzunyan, and É. P. Ufa, *Economic Substantiation of the Choice of Diamond Wheels* [in Russian], Prapor, Kharkov (1971).
2. A. V. Popov, "Effect of grain size of diamond wheels on the production cost and quality of grinding of high-quality and art glass," *Steklo Keram.*, No. 11, 9 – 10 (2001).